

## Short Note

Pablo Edmundo Ortiz\* and Jorge Pablo Jayat

# The Quaternary record of *Reithrodon auritus* (Rodentia: Cricetidae) in northwestern Argentina and its paleoenvironmental meaning

**Abstract:** *Reithrodon auritus* is a living sigmodontine with one of the broader temporal records, from the lower Pliocene of Argentina. Its populations in northwestern Argentina are today found patchily and restricted to five high-elevation and isolated localities in open areas of highland grasslands vegetation (at >3000 m). During the Pleistocene and early Holocene, *R. auritus* would have had a broader range, reaching lower altitudes everywhere and being one of the dominant small mammal species in some fossil localities. In this note, we summarize the known Pleistocene and early Holocene fossil record of *R. auritus* in northwestern Argentina, provide new paleontological sites for the species, and make comments concerning the paleoenvironmental implications of its presence at such lower altitudes. The paleontological evidence indicates that during the Pleistocene and early Holocene, *R. auritus* inhabited around 1000 m below their current altitudinal distribution in the eastern Andean ranges, with populations clearly more abundant than today. The fossils of *R. auritus* are indicative of colder and perhaps more xeric paleoenvironmental conditions, characterized by open areas with sparse grassy vegetation as those developed today around 3000 m elevation.

**Keywords:** Catamarca; early Holocene; Pleistocene; Sigmodontinae; Tucumán.

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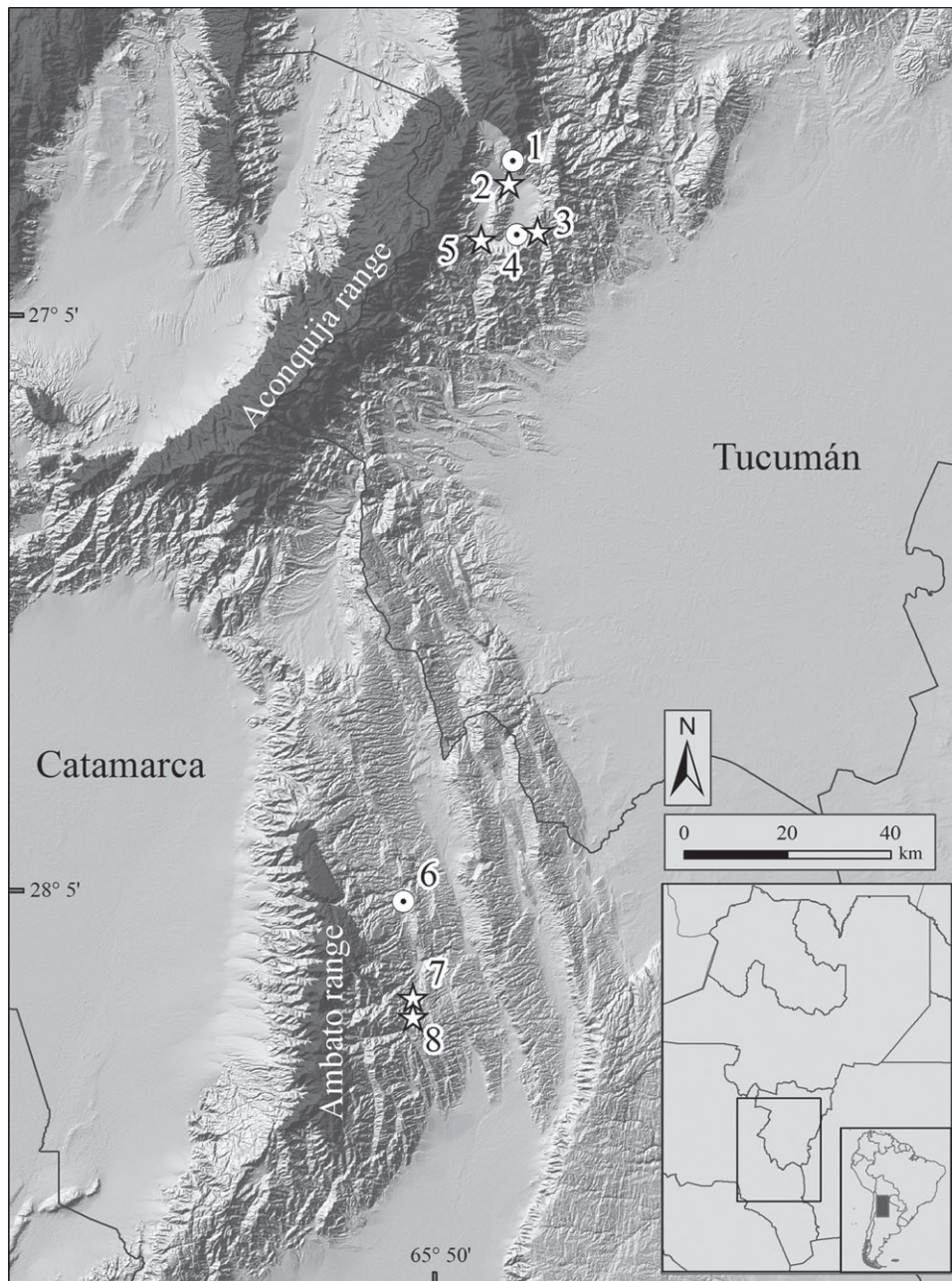
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(e.g., Andrews 1990, Avery 1997, Cuenca Bescós et al. 2005, Fernández et al. 2012). Among these mammals, the rodents of the subfamily Sigmodontinae are today the most diverse group in South America, having a rich Quaternary fossil record (Pardiñas et al. 2002, Ortiz et al. 2011a). In northwestern Argentina, a number of findings have expanded the paleontological knowledge for the group, with several new fossiliferous localities added to the record, spanning from middle-late Pleistocene to late Holocene, and covering much of the environmental heterogeneity of the region (Ortiz 2001, Ortiz and Pardiñas 2001, Pardiñas and Ortiz 2001, Teta and Ortiz 2002, Ortiz and Jayat 2007a,b, Ortiz et al. 2011a,b, 2012).

*Reithrodon auritus* (Fischer 1814) is a living sigmodontine with one of the broader temporal records, from the lower Pliocene in the Pampean region along all Quaternary in several localities of Argentina and southern Chile (Pardiñas and Galliari 2001, Pardiñas et al. 2002). Although this species currently presents a broad distribution (Pardiñas and Galliari 2001), from the southern tip of South America up to northern Argentina, their northernmost populations are today found only patchily and restricted to five high-elevation and isolated localities (Dalby and Mares 1974, Ortiz et al. 2000, Pardiñas and Galliari 2001, Jayat et al. 2006, 2008). Most of the present and fossil records for *R. auritus* in northwestern Argentina come from the eastern Andean slopes on Ambato and Aconquija ranges (Catamarca and Tucumán provinces, respectively; see Figure 1). In these two mountain systems, *R. auritus* was trapped exclusively at more than 3000 m, in open areas of highland grasslands vegetation (Thomas 1920, Pardiñas and Galliari 2001, Jayat et al. 2008). Additionally, and in spite of the analysis of many owl pellet samples coming from these areas, only one record for this species comes below that altitude (Jayat et al. 2006, 2008).

In contrast with this distribution in isolated patches, during the Pleistocene and early Holocene *Reithrodon auritus* would have had a broader range, reaching lower altitudes everywhere and being one of the dominant

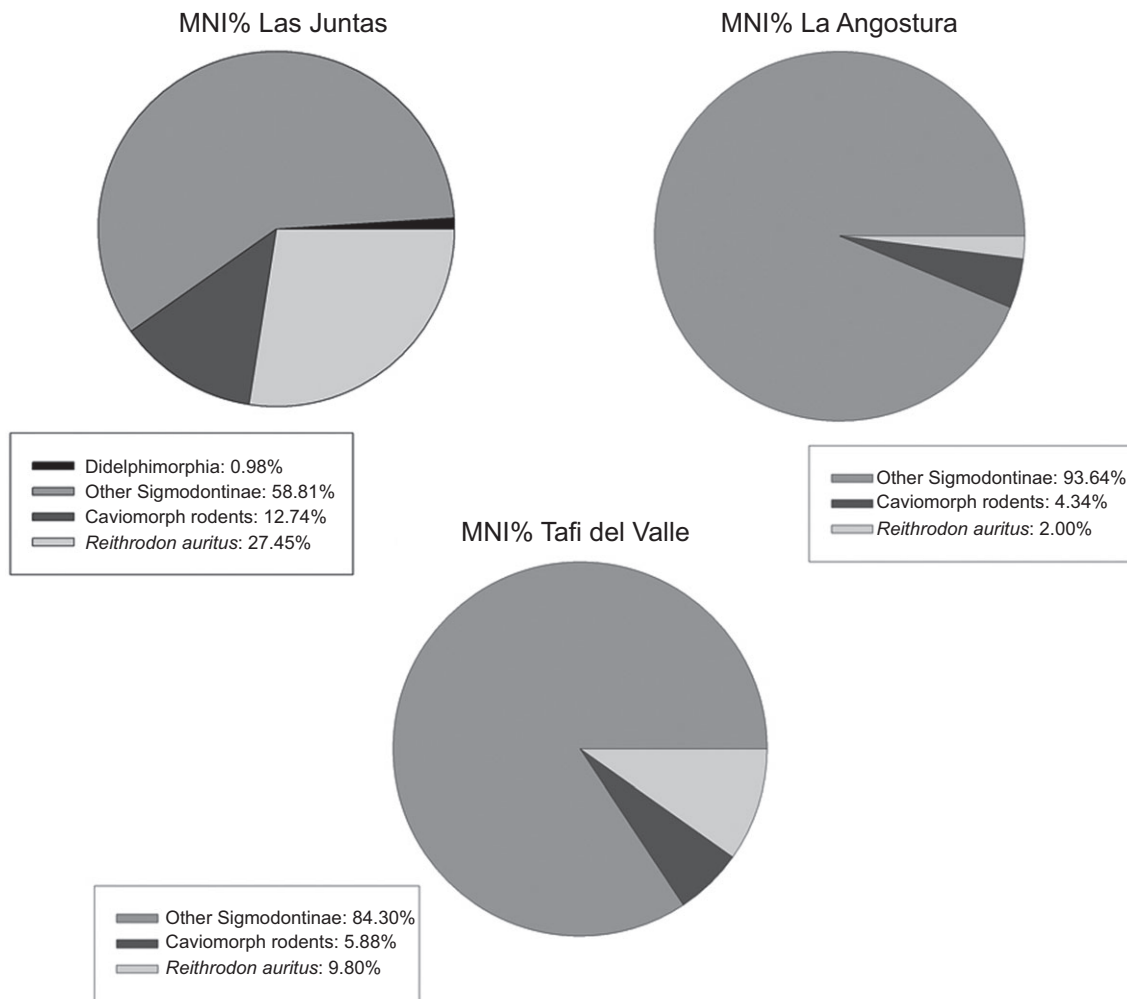
Fossil small mammals have been used as a useful tool in paleoenvironmental reconstruction around the world



**Figure 1** Areas of Aconquija and Ambato ranges showing the location of paleontological sites referred in the text. 1. – Tafi del Valle; 2. – northern end of Loma Pelada; 3. – Cerro de los Menhires; 4. – La Angostura; 5. – La Mesada; 6. – Las Juntas; 7. – 3 km south of El Rodeo; 8. – 10 km south of El Rodeo. Darker gray areas indicate lands on Aconquija and Ambato ranges above 3000 m elevation. Circles: Records from the literature. Stars: New records.

small mammal species in some fossil localities (Figure 2; Ortiz and Pardiñas 2001, Ortiz and Jayat 2007a, Ortiz et al. 2011a,b). In this note, we summarize the known Pleistocene and early Holocene fossil record of *R. auritus* in northwestern Argentina, provide new paleontological sites for the species, and make comments concerning the paleoenvironmental implications of its presence at such lower altitudes.

Fieldworks in Catamarca and Tucumán provinces carried out between 2006 and 2011 allowed us to expand the known Pleistocene and early Holocene records for *Reithrodon auritus* in northwestern Argentina, adding five new fossil localities (Figure 1). The new records, mostly represented by isolated skull fragments, mandibles, and teeth (Appendix, Figure 3), come from three localities of the Tafi valley, Tucumán province (northern end of Loma



**Figure 2** Relative abundance of *Reithrodon auritus* in three Quaternary micromammal samples in northwestern Argentina. MNI%: percentage of minimal number of individuals. Total MNI La Angostura: 299; total MNI Tafi del Valle: 51; total MNI Las Juntas: 105.

Pelada, late Pleistocene, 26°52'56" S, 65°43'20" W, 2030 m; Cerro de los Menhires, late Pleistocene, 26°55'53" S, 65°40'41" W, 1950 m; La Mesada, late Pleistocene, 26°56'52" S, 65°45'54" W, 2280 m), and two from the vicinities of El Rodeo, Catamarca province (3 km south of El Rodeo, late Pleistocene, 28°16'42" S, 65°53'00" W, 1490 m; 10 km south of El Rodeo, late Pleistocene, 28°18'11" S, 65°53'32" W, 1680 m) (Figure 1).

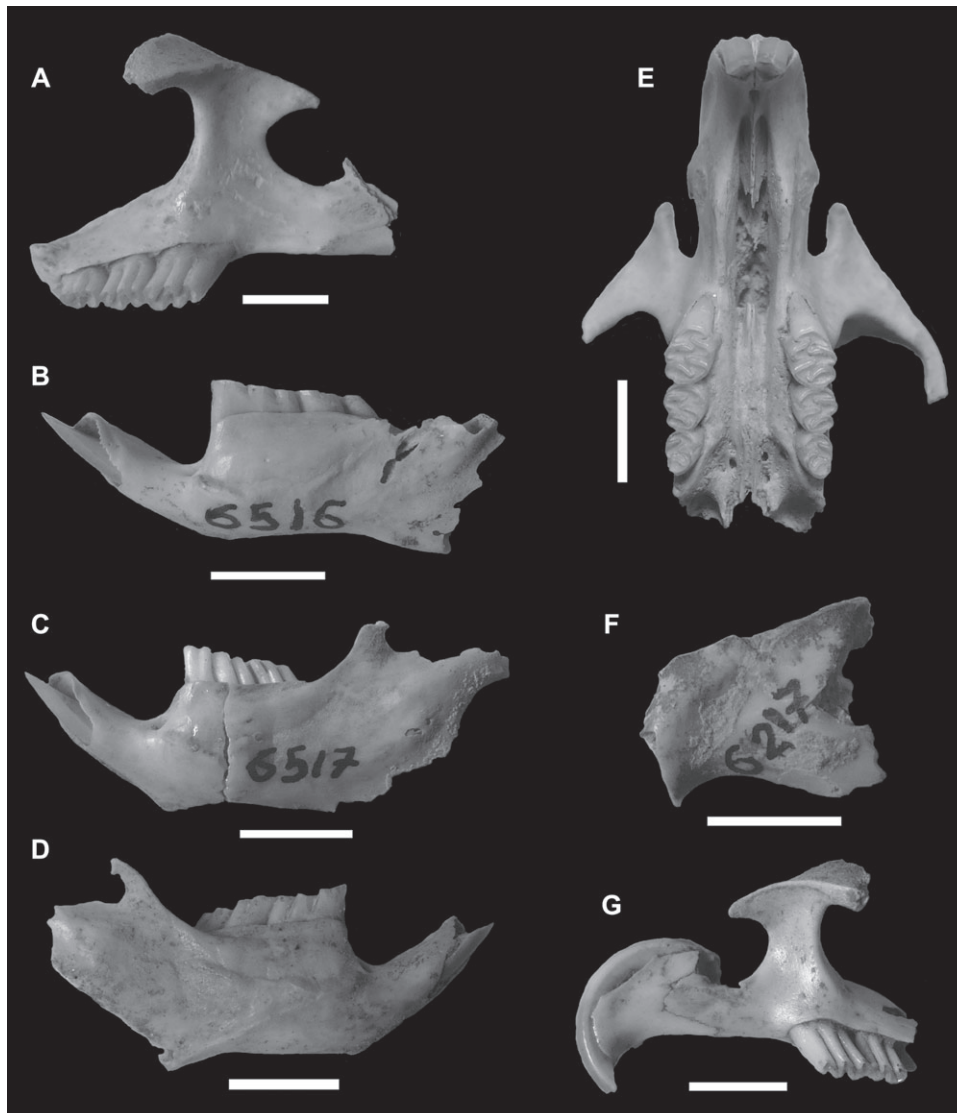
The fossil remains were exhumed from loessic sediments assigned to middle-late Pleistocene and early Holocene, referable to the Tafi del Valle Formation (Kemp et al. 2003, 2004, Schellenberger et al. 2003, Sayago et al. 2005, Carter-Stiglitz et al. 2006, Ortiz et al. 2011b). However, in spite of lithological similarities with the stratotype in the Tafi valley, the assignation of the sediments from the El Rodeo area to this geologic unit is tentative (Sayago et al. 2005).

All the new records come from the same general area where previous material was obtained, including

the localities of La Angostura (middle-late Pleistocene, 26°55'56" S, 65°40'34" W, 1890 m; Ortiz and Pardiñas 2001), Tafi del Valle (10,100 cal years BP, 26°51'41" S, 65°43'08" W, 2007 m; Ortiz and Jayat 2007a), and Las Juntas (13,200 cal years BP, 28°06'37" S, 65°53'55" W, 1560 m; Ortiz et al. 2011b) (Figure 1).

The paleontological evidence indicates that during the Pleistocene and early Holocene *Reithrodon auritus* inhabited around 1000 m below their current altitudinal distribution in these Andean ranges. In addition to this broader distributional range, and according to the analyzed evidence, Quaternary populations of this rodent were clearly more abundant than today, reaching more than 27% of the specimens (12 small mammal species) recovered in Las Juntas (Ortiz et al. 2011a) and a frequency of 10% among the nine taxa recorded in Tafi del Valle (Ortiz and Jayat 2007a) (Figure 2). The extremely low abundance of *R. auritus* in northwestern Argentina at present times is evident from the study of many owl pellet





**Figure 3** Fossil specimens of *Reithrodon auritus* recovered in the study area. (A) PVL 6519: northern end of Loma Pelada; (B) PVL 6516: 10 km south of El Rodeo; (C) PVL 6517: La Mesada; (D) PVL 6523: northern end of Loma Pelada; (E) PVL 6522: northern end of Loma Pelada; (F) PVL 6217: 3 km south of El Rodeo; (G) PVL 6521: Cerro de los Menhires.

samples and a number of trapping data. The species is absent in several highland localities characterized by potentially suitable environments (Ortiz and Pardiñas 2001, Ortiz and Jayat 2007a, Ortiz et al. 2010, 2011b) or attained very low frequencies, below 1% (Jayat et al. 2008, Ortiz et al. 2012).

The fossils of *Reithrodon auritus* in the area are indicative of colder and perhaps more xeric paleoenvironmental conditions, characterized by open areas with sparse grassy vegetation as those developed today around 3000 m elevation. The consideration of *R. auritus* as an indicator of arid or semiarid conditions in the Pampean region (e.g., Tonni et al. 1988, Bonomo et al. 2009) has been recently

challenged (Scheifler et al. 2012). Notwithstanding, the assignation of populations of *Reithrodon* from northwestern Argentina to *R. auritus* remains controversial, as these perhaps should be referred to *Reithrodon caurinus* Thomas, 1920 (see Ortiz et al. 2011b). This suggests caution in extrapolating environmental requirements of Pampean populations to highland areas of northwestern Argentina. Most importantly, some small mammals associated with *R. auritus* in the fossil samples of La Angostura (e.g., *Neotomys ebriosus* Thomas, 1894), the northern end of Loma Pelada (*N. ebriosus*), and Las Juntas (*Abrocoma cinerea* Thomas, 1919), also indicate the presence of current high-altitude vegetation belts at lower elevations

(Ortiz and Pardiñas 2001, Pardiñas and Ortiz 2001, Ortiz et al. 2011a,b). Clearly, the paleodistribution of *R. auritus* and other small mammals in northwestern Argentina suggests that those climatic conditions may correspond to different cold pulses during the Pleistocene and early Holocene, which caused the cyclic descent of the vegetation belts. These climatic and environmental events were also proposed on the basis of other evidences, including geomorphologic, paleopedologic, sedimentological, and palynological data (e.g., Iriondo 1993, Sayago et al. 1998, Schäbitz et al. 2001, Zinck and Sayago 2001).

In a broad sense, the fossil record of *Reithrodon auritus* in northwestern Argentina suggests a complex pattern of range expansions during cold times (associated with the descents of vegetation belts) and range contractions during more temperate times (associated with the isolation of populations on mountain tops), in response to glacial-interglacial cycles during the Pleistocene to early Holocene. This pattern is clearly viewed in the Aconquija and Ambato ranges, where *R. auritus* was one of the dominant small mammal species during the Pleistocene-Holocene boundary (Ortiz and Jayat 2007a, Ortiz et al. 2011b).

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## Appendix

New fossil material of *Reithrodon auritus* from Tafi valley and El Rodeo area. PVL: Colección de Paleontología de Vertebrados del Instituto Miguel Lillo, Universidad Nacional de Tucumán, Tucumán, Argentina.

TUCUMÁN: Northern end of Loma Pelada: PVL 6519, right maxilla with M1-M3; PVL 6522, anterior fragment of skull and several postcranial bones; PVL 6523: right mandible with incisor and m1-m3. La Mesada: PVL 6518, right mandible with m1-m3; PVL 6517, left mandible with incisor and m1-m2. Cerro de los Menhires: PVL 6521, left premaxilla with incisor and maxilla with M1-M2.

CATAMARCA: 3 km south of El Rodeo: PVL 6217, left premaxilla and fragment of maxilla; 10 km south of El Rodeo: PVL 6516, left mandible with m1-m2.

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